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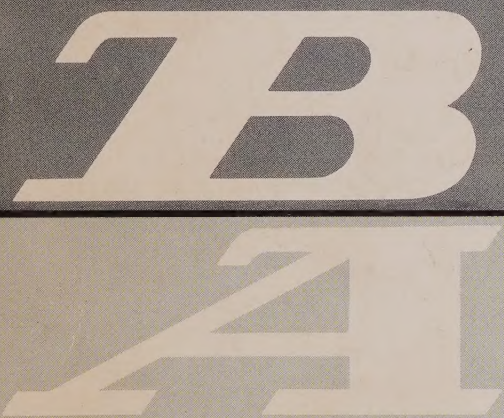


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Instruction Manual

Model 312

Super-Stable High Voltage Power Supply

**Baird-Atomic, Inc.
Cambridge, Mass. USA**

FOREWORD

Through creative development of superior instrumentation Baird-Atomic, Inc., has established a leading position in the field of instruments and controls. In our laboratory and plant we combine research and precision workmanship to produce reliable radiation measurement instruments for scientific research laboratories. The company emphasizes the development and production design of basic and often difficult phases of instrumentation.

Many of our product ideas originate in our own laboratories. In addition, our staff works closely with leaders in the atomic field of both the United States and Canada to translate their valuable but unstandardized tools into dependable and reproducible equipment for wide laboratory use. Sound in conception and manufacture, our products save the valuable time of the scientific personnel who use them.

We also produce specific-purpose instruments for chemical, medical, safety, industrial radioactivity, and industrial counting work. The engineering, workmanship, and components in the instruments and accessories are of the same high quality we insist upon in our nuclear research tools.

The satisfaction of our customers, as reflected by hundreds of reports of the reliable functioning of our products over long periods of exacting use, is both our reward and contribution to the scientific fields in which we work.

We are glad to have you as a customer and hope to enjoy with you a cordial relationship over many years.

SUPER-STABLE HIGH VOLTAGE POWER SUPPLY MODEL 312

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APPENDIX I SCHEMATIC DIAGRAM MODEL 312

WARNING

Voltages as high as 4000 volts exist within this equipment, contact with such voltage may prove fatal. Avoid accidental contact with any of the metallic 85A2 tube retainers which carry high voltage when the Power Supply is energized. EXTREME CAUTION should be exercised if the equipment is operated without protective cover screens. All high-voltage oil capacitors should be discharged prior to working on interior parts of this unit.

I. GENERAL DESCRIPTION

The Model 312 High Voltage Power Supply was developed to provide a highly stable d-c voltage source which is generally required for precision scintillation counting. Voltage drift has been reduced to an absolute minimum; it is possible to start an experiment a second time with virtually unchanged voltage conditions.

The Model 312 Power Supply consists of an input regulating transformer followed by a conventional high voltage transformer, rectifier, and R-C filter network. The filtered d-c voltage is applied to a bank of 17 cold cathode tubes from which the regulated output voltage is obtained.

In physical layout, the Model 312 Power Supply consists of a modular double-chassis assembly, panel mounted in a bottom-and-top ventilated cabinet. The front panel carries the voltage indicating meter and all necessary operating controls. The entire assembly may be removed from its own cabinet and mounted in a standard 19-inch relay rack or cabinet. Figures 1 and 4, giving outline drawings with dimensions, will aid in

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planning an installation. The principal electrical characteristics of the unit are summarized in Table 1.

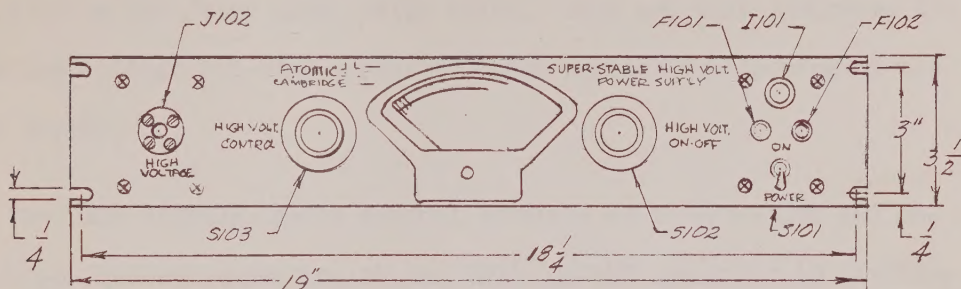


Figure 1. Front Panel

Table 1

Operating Specifications

AC 60-Cycle Transformer Type.

Range: From less than 100 V to greater than 1400 V in 17 steps.

Maximum load current: 1 milliamp.

Load regulation: Output voltage changes less than 0.35% for current increase from zero to maximum load.

Line regulation: Output voltage changes less than 0.00035% per volt change of line from 100-130 V.

Stability: Approximately 0.02% per day.

Ripple: Less than 0.01% of output voltage.

Power requirements: 30 watts.

Positive or negative output controlled by front panel switch.

II. OPERATION

The equipment is energized by throwing the POWER Switch to the ON position which also lights an indicator lamp.

Voltage adjustment is effected by means of the HIGH VOLTAGE CONTROL, a 17-position switch which increases the output high voltage with



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clockwise rotation in 17 equal steps. The HIGH VOLTAGE CONTROL step positions are lettered from A to Q to correspond with similarly marked positions on the front panel meter scale. This not only indicates the operating voltage but also serves to check correct functioning of the Power Supply.

The HIGH VOLTAGE ON-OFF control consists of a 5-position switch. The output voltage appearing at the HIGH VOLTAGE Connector is positive or negative with respect to chassis ground depending on whether the HIGH VOLTAGE ON-OFF control is turned to the +H.V. or -H.V. position. Turning this control to any one of the 3 OFF positions removes output voltage from the HIGH VOLTAGE Connector and meter circuit without shutting off line power. Thus this control functions as a stand-by switch. As a safety feature, 3 detents are provided for the OFF positions to avoid any possibility of accidentally switching directly from one output voltage polarity to the opposite polarity. Application of reverse polarity can permanently damage some radiation detectors.

For maximum voltage stability, at least 1 hour - preferably 2 - should be allowed for warm-up. It is recommended that operation of this Power Supply take place at an ambient temperature which is maintained at a reasonably constant level.

For quiet operation of the Power Supply, it is essential that all screws used to fasten down chassis cover screens be tightened securely to prevent transmission of audible 60 cycle vibration from the voltage stabilizing transformer.

It is possible that some drift will be noted in the front panel meter reading, but this will be limited to the 2% full-scale tolerance

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set by the meter manufacturer and drift in the meter circuit resistors. Such drift does not imply instability in the output voltage of the Model 312 Power Supply. The mechanical zero of the meter can be checked occasionally by turning the HIGH VOLTAGE ON-OFF Switch to the OFF position.

III. THEORY OF OPERATION

Block diagram, Figure 2, outlines the circuit in simplified form. Input regulating transformer T101 stabilizes against line voltage fluctuations. T101 in turn energizes high-voltage transformer T102 which, with V101, forms a conventional half-wave rectifier circuit. This is followed by a condenser input R-C filter arrangement. The filtered d-c voltage is dropped by limiting resistors R111 and R112 to supply ignition voltage to high-stability voltage reference tubes V102 to V118 inclusive. The regulating action of these gas-filled diodes derives from the fact that the voltage across such tubes is practically independent of the current through them when the current range is restricted within certain specified limits. The entire d-c system is essentially balanced with respect to ground, depending upon the setting of S103.

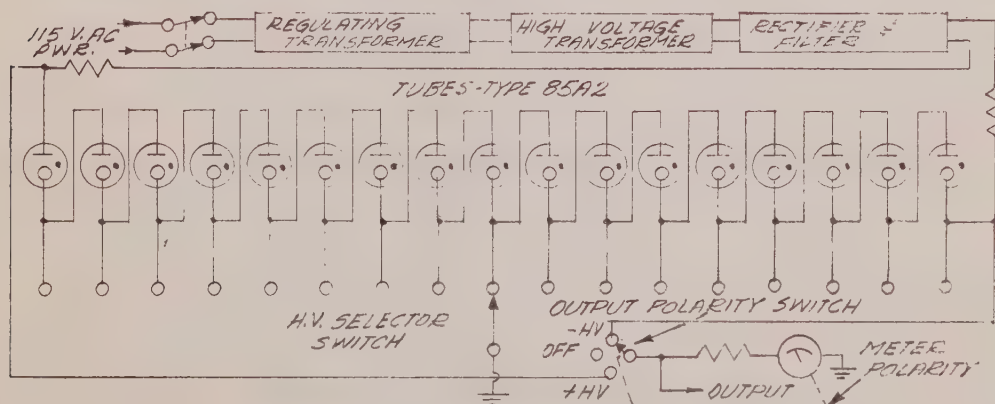


Figure 2. Block Diagram

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Voltage output is adjustable in 17 steps of approximately 85 volts each by means of HIGH VOLTAGE CONTROL Switch S103 which varies the number of voltage reference tubes connected between the high-voltage jack and chassis ground. Achievement of day-to-day voltage reproducibility is aided by this fixed setting arrangement.

Output voltage polarity is controlled by the 5-position HIGH VOLTAGE ON-OFF Switch S102. This switch reverses terminal connections on meter M101 to indicate correct voltage regardless of polarity and, in the OFF positions, serves as a stand-by switch as explained in section II.

Output voltage is indicated by M101, a 200-microampere meter paralleled for calibration purposes by Rx.

IV. MAINTENANCE

The most likely source of malfunctioning in this equipment is found in the series-connected bank of cold cathode tubes, V102 thru V118. Failure of the 85A2 regulator tubes to ignite will be evidenced by a tendency for the front panel meter to read off-scale at the high end due to loss of regulation. In this case, turn the HIGH VOLTAGE ON-OFF Switch to the OFF position to prevent meter damage. Locate the defective tube by shorting out one tube at a time, until the entire string of regulator tubes lights up. This can be done by using a screwdriver with an insulated handle, shorting out each tube between base pins #1 and #7. Replace the defective tube in the socket which was shorted out.

If more than one tube is defective, it may be necessary to short out small groups of regulator tubes using a technique similar to that outlined above. It is possible for a defective regulator tube to ignite

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and show an abnormally high anode-to-cathode voltage drop. Locate this type of defect by indexing the HIGH VOLTAGE CONTROL through steps "A" to "Q" and noting on the front panel meter whether each step increases the output by approximately 85 volts. For example, if the HIGH VOLTAGE ON-OFF Switch is set at +H.V., and all HIGH VOLTAGE CONTROL positions preceding "K" show normal voltages increments, then, an abnormal voltage increase at position "K" would indicate that V112 is defective.

A spare 85A2 tube is provided with each unit. In an emergency, type 5651 voltage reference tubes may be used in place of the 85A2 tubes -- at some sacrifice in voltage stability.

Table 2, Voltage and Resistance Measurements, and a Schematic Diagram are included to assist in isolating circuit faults and making repairs. All electrical components are identified by symbol numbers in Figures 1, 3 and 4 for easy location. These components are described in the Parts List where the figure in which the part is located and identified is listed.

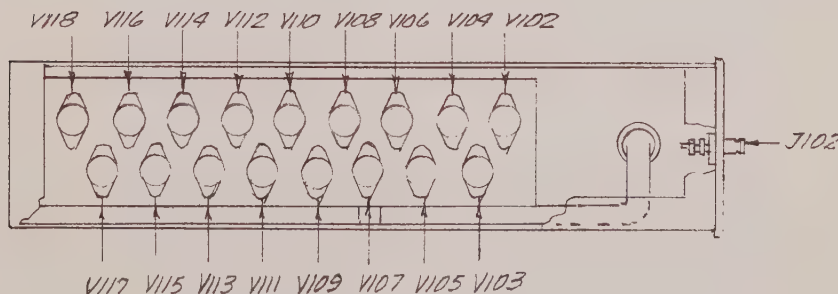
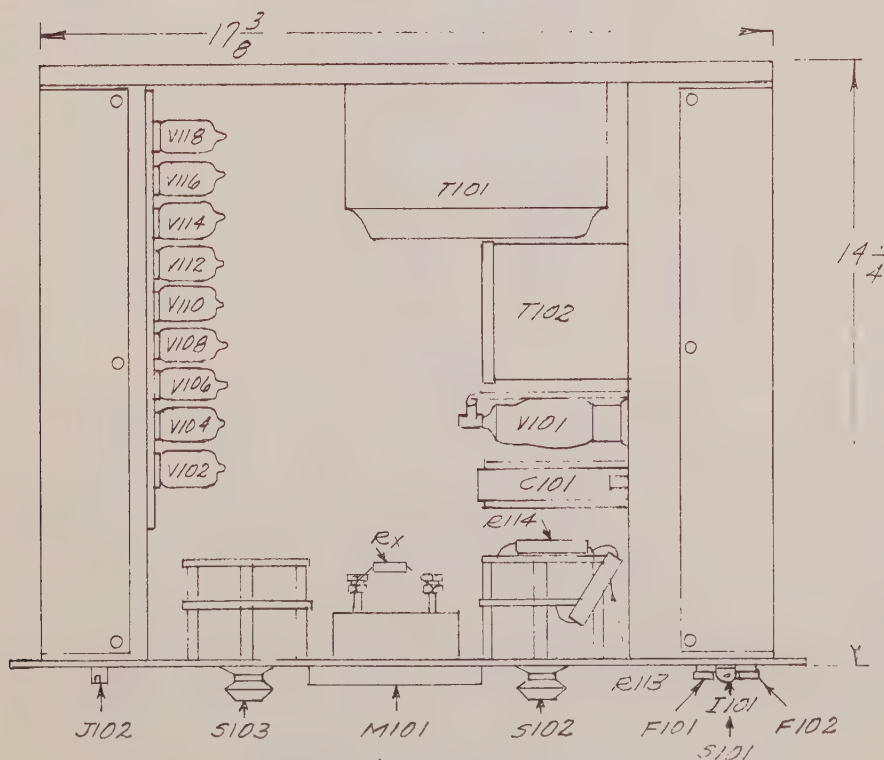
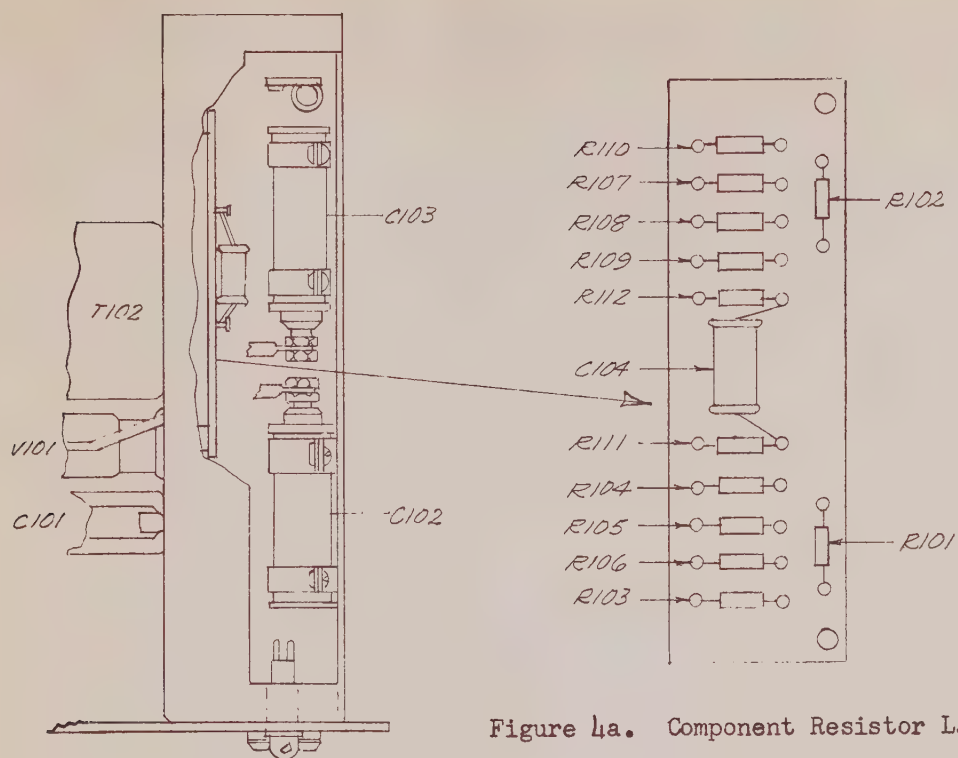


Figure 3. Component Tube Layout

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TABLE 2-VOLTAGE AND RESISTANCE MEASUREMENTS

TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6 **	PIN 7	CAP
V101	V 1900 R 5M	-----	-----	V 1900 R 5M	-----	-----	-----	V 2850 AC* R 170K
V102	V 1435 R 5M	V 1350 R ∞	V 1435 R 5M	V 1350 R ∞	V 1435 R 5M	-----	V 1350 R ∞	-----
V103	V 1350 R ∞	V 1266 R ∞	V 1350 R ∞	V 1266 R ∞	V 1350 R ∞	-----	V 1266 R ∞	-----
V104	V 1266 R ∞	V 1182 R ∞	V 1266 R ∞	V 1182 R ∞	V 1266 R ∞	-----	V 1182 R ∞	-----
V105	V 1182 R ∞	V 1097 R ∞	V 1182 R ∞	V 1097 R ∞	V 1182 R ∞	-----	V 1097 R ∞	-----
V106	V 1097 R ∞	V 1013 R ∞	V 1097 R ∞	V 1013 R ∞	V 1097 R ∞	-----	V 1013 R ∞	-----
V107	V 1013 R ∞	V 928 R ∞	V 1013 R ∞	V 928 R ∞	V 1013 R ∞	-----	V 928 R ∞	-----
V108	V 928 R ∞	V 844 R ∞	V 928 R ∞	V 844 R ∞	V 928 R ∞	-----	V 844 R ∞	-----
V109	V 844 R ∞	V 760 R ∞	V 844 R ∞	V 760 R ∞	V 844 R ∞	-----	V 760 R ∞	-----
V110	V 760 R ∞	V 675 R ∞	V 760 R ∞	V 675 R ∞	V 760 R ∞	-----	V 675 R ∞	-----
V111	V 675 R ∞	V 591 R ∞	V 675 R ∞	V 591 R ∞	V 675 R ∞	-----	V 591 R ∞	-----
V112	V 591 R ∞	V 506 R ∞	V 591 R ∞	V 506 R ∞	V 591 R ∞	-----	V 506 R ∞	-----
V113	V 506 R ∞	V 422 R ∞	V 506 R ∞	V 422 R ∞	V 506 R ∞	-----	V 422 R ∞	-----
V114	V 422 R ∞	V 338 R ∞	V 422 R ∞	V 338 R ∞	V 422 R ∞	-----	V 338 R ∞	-----
V115	V 338 R ∞	V 253 R ∞	V 338 R ∞	V 253 R ∞	V 338 R ∞	-----	V 253 R ∞	-----
V116	V 253 R ∞	V 169 R ∞	V 253 R ∞	V 169 R ∞	V 253 R ∞	-----	V 169 R ∞	-----
V117	V 169 R ∞	V 84 R ∞	V 169 R ∞	V 84 R ∞	V 169 R ∞	-----	V 84 R ∞	-----
V118	V 84 R ∞	V 0 R 0	V 84 R ∞	V 0 R 0	V 84 R ∞	-----	V 0 R 0	-----

LEGEND

*	A-C voltage to terminal 3 of T102.
**	No electrical connection to this pin. A voltage and high resistance to other pins normally may be measured due to internal leakage.
V	Indicates d-c voltage to chassis ground unless otherwise specified.
R	Indicates resistance to chassis ground unless otherwise specified.
	Voltage and resistance measurements above are made with S102 set at +H.V. and S103 set at position "Q". A Simpson Model 260 Volt-Ohm-Milliammeter having an internal resistance of 20,000 ohms per volt DC and 1000 ohms per volt AC was used.

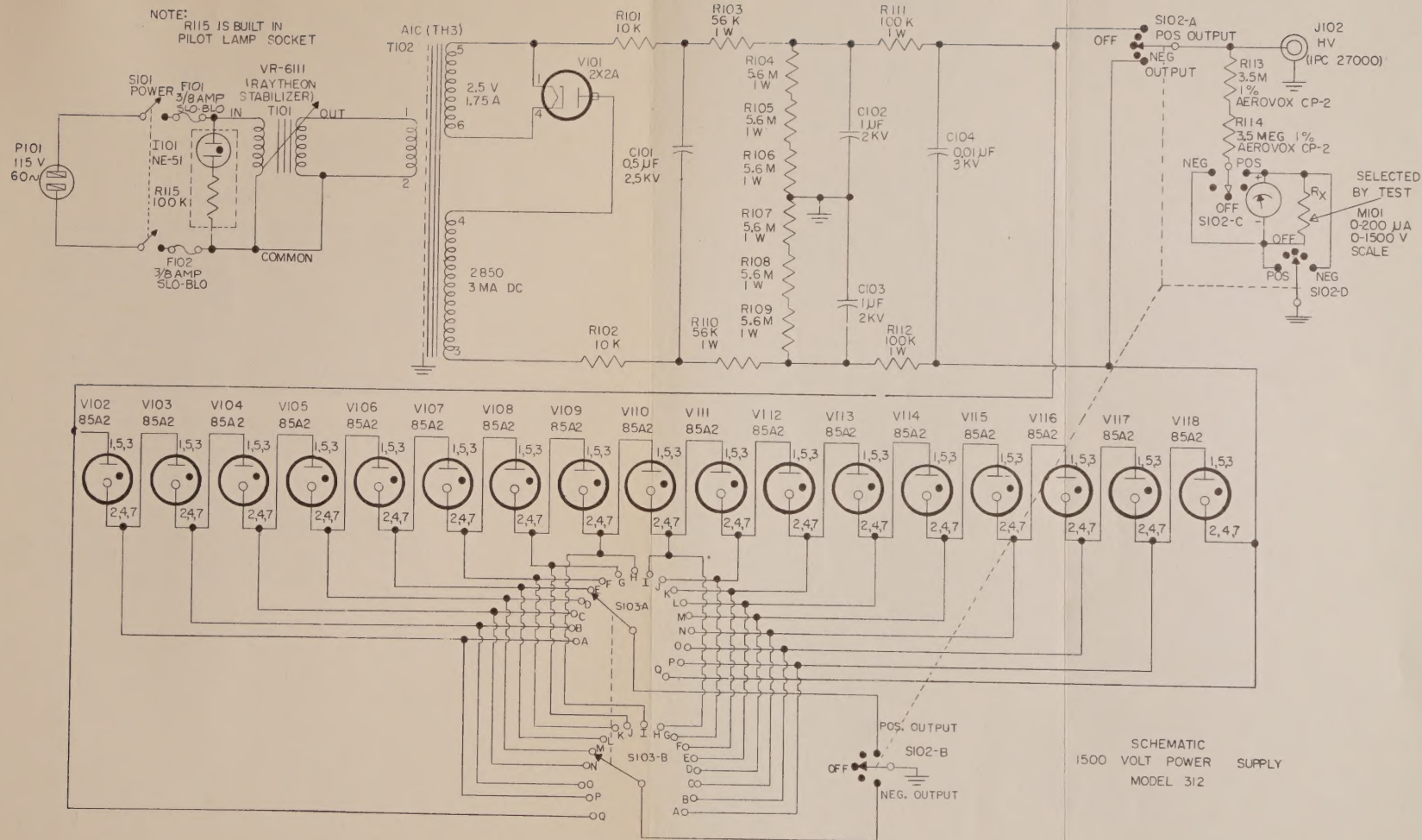
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PARTS LIST			
Symbol Designation	Description	Figure No.	AIC No.
C-101	0.5 mf., oil filled, 2.5 KV	4b	CP-504-1
C-102	1 mf., oil filled, 2 KV	4a	CP-105-2
C-103	1 mf., oil filled, 2 KV	4a	CP-105-2
C-104	0.01 mf., silicone filled, 2 KV	4a	CG-103-4
F-101	0.5 amp., 250 V, 3 AG	1	FS-5
F-102	0.5 amp., 250 V, 3 AG	1	FS-5
I-101	Lamp, NE-51	1	LA-8
J-102	HV coaxial connector	1	JK-1
M-101	Meter, 200 μ a, 0-1500 V full scale, 330 ohms	4b	MT-10
P-101	Line cord and plug		LC-1
R-101	10K, 5%, 1/2 W, comp.	4a	RCE-103J
R-102	10K, 5%, 1/2 W, comp.	4a	RCE-103J
R-103	56K, 5%, 1 W, comp.	4a	RCG-563J
R-104	5.6 meg., 5%, 1 W, comp.	4a	RCG-565J
thru			
R-109			
R-110	56K, 5%, 1 W, comp.	4a	RCG-563J
R-111	100K, 5%, 1 W, comp.	4a	RCG-104J
R-112	100K, 5%, 1 W, comp.	4a	RCG-104J
R-113	3.5 meg., 1%, 2 W, film type	4b	RF-355-2
R-114	3.5 meg., 1%, 2 W, film type	4b	RF-355-2
R-115	100K*		
R x	1/2 W, comp., value determined at factory	4b	
S-101	DPDT, toggle	1	ST-1
S-102	Two section rotary, 6 poles, 3 pos	1	SR-30
S-103	Two section rotary, 2 poles, 17 positions, shorting.	1	SR-31
T-101	Transformer, constant voltage, primary 95-130 V, 60 cycle; secondary 115 V at 0.26 amp.	4b	TP-20

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PARTS LIST (Continued)			
Symbol Designation	Description	Figure No.	AIC No.
T 102	Transformer; primary 117 V, 50-60 cycle; secondary 2850 V at 3 ma., 2.5 V at 1.75 amp.	4b	TH-3
V 101	2X2A, half-wave high-vacuum rectifier	4b	2X2A
V 102 thru V 118	85A2, voltage reference	3	85A2

*R 115 is built in pilot lamp assembly; AIC Part No. LA-7.



WARRANTY

Baird-Atomic, Inc. (the "Company"), warrants this equipment for a period of 1 year from the date of shipment as follows: it warrants that all equipment of its manufacture is free from defects in material and workmanship at the time of shipment. If within 1 year of shipment any equipment of the Company's manufacture develops defects in material or workmanship under normal conditions of operation, the buyer of the equipment may return it to the Company within 30 days of such failure, for repairs at the expense of the Company, including the expense of shipment, or in the case of any defective part may return such part to the Company which will repair or replace the same at its expense, including the cost of shipment. A further warranty of 1 year on the same terms shall be applicable to any part so repaired or replaced. Except for Dekatron glow tubes, this warranty does not extend to stock components not manufactured by the Company.

The Company shall not be liable for damage or destruction of instruments during delivery or caused by other than employees of Baird-Atomic, Inc.; in any event, liability shall not exceed the cost of replacement of defective parts upon prompt notification of such defect.

For return of equipment or any part thereof under the terms of the foregoing warranty a letter should be forwarded to Baird-Atomic, Inc., Attention: Sales Service Department, 33 University Road, Cambridge 38, Massachusetts. It should state owner's name and address; model and serial number of the equipment; the order number, under which it was purchased; the date of failure and a description of the circumstances surrounding same. Upon receipt of such information, shipping instructions for return of equipment or parts thereof will be forwarded promptly.

Baird-Atomic, Inc.

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